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Hanano

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(54) **IMAGE FORMING APPARATUS**

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G03G 21/18 (2006.01)
G03G 15/00 (2006.01)

(52) **U.S. Cl.**
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CPC G03G 15/75; G03G 15/751; G03G 21/1842; G03G 21/185; G03G 21/1647; G03G 2221/1654
See application file for complete search history.

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(57) **ABSTRACT**

An image forming apparatus (**1**) includes an image carrier unit (**15**) and a positioning member (**30**) configured to position the image carrier unit (**15**) to the apparatus main body (**2**). The image carrier unit (**15**) has a concentric circumference part (**51**L), (**51**R) formed on a concentric circle with a rotating shaft (**9***a*) of the image carrier (**9**) and the apparatus main body (**2**) has an edge part (**42**L), (**42**R) facing the concentric circumference part (**51**L), (**51**R) at the attachment position. The positioning member (**30**) has an intervening part (**37**) formed with an edge side abutment face (**37***a*) facing the edge part (**42**L), (**42**R) of the apparatus main body (**2**) and a unit side abutment face (**37***b*) facing the concentric circumference part (**51**L), (**51**R) of the image carrier unit (**15**).

9 Claims, 10 Drawing Sheets

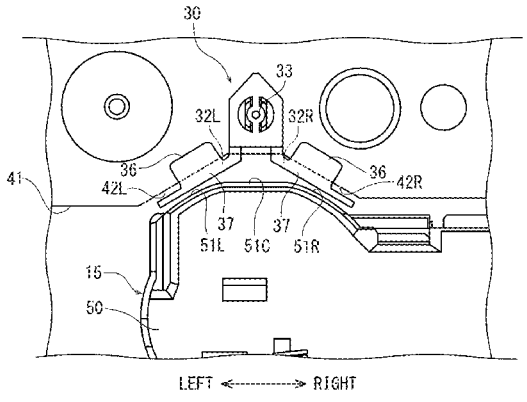

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FIG.1

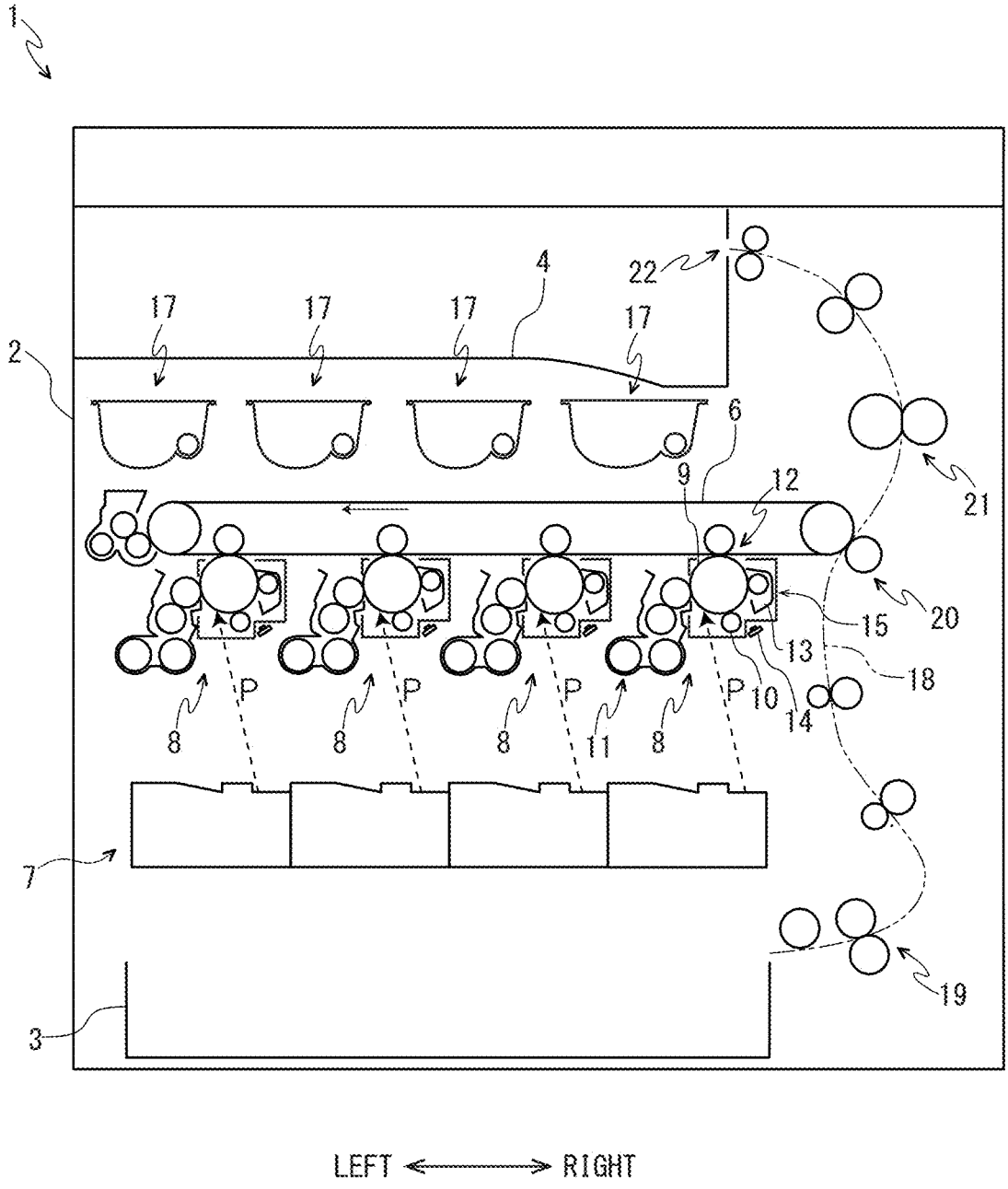

FIG.2

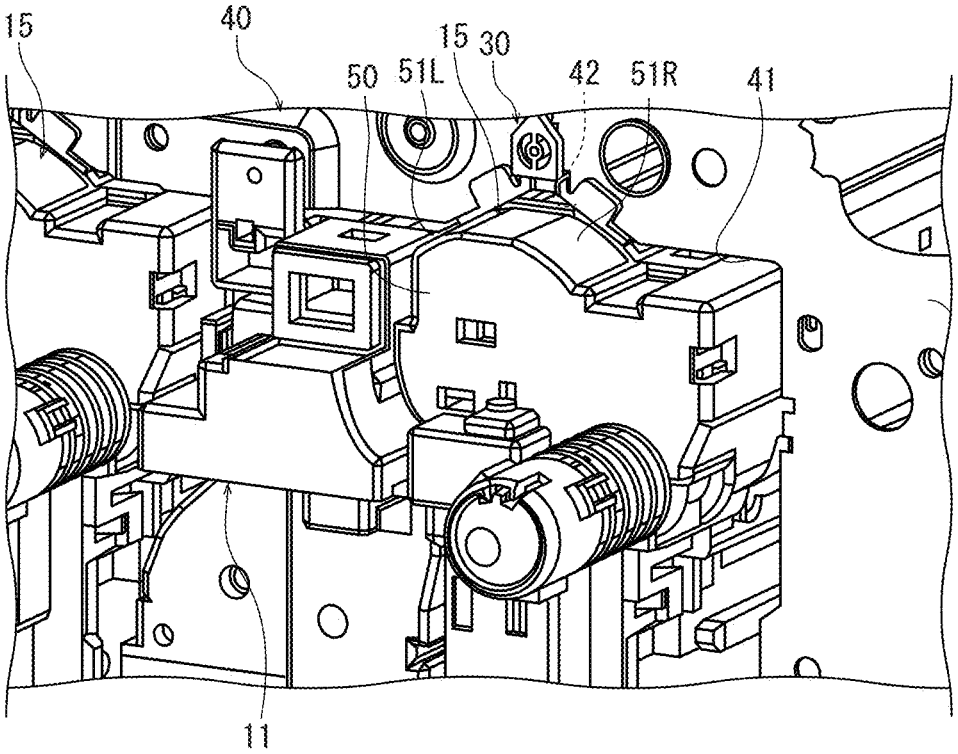

FIG.3

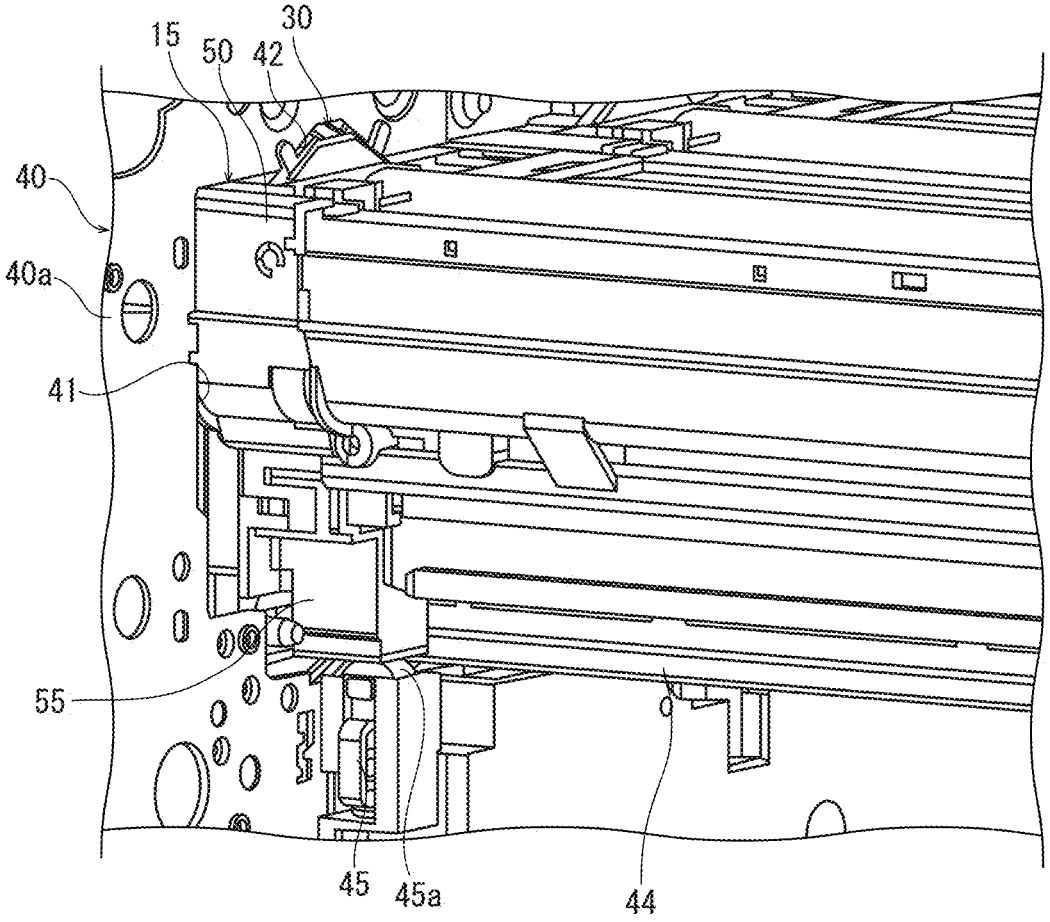

FIG.4

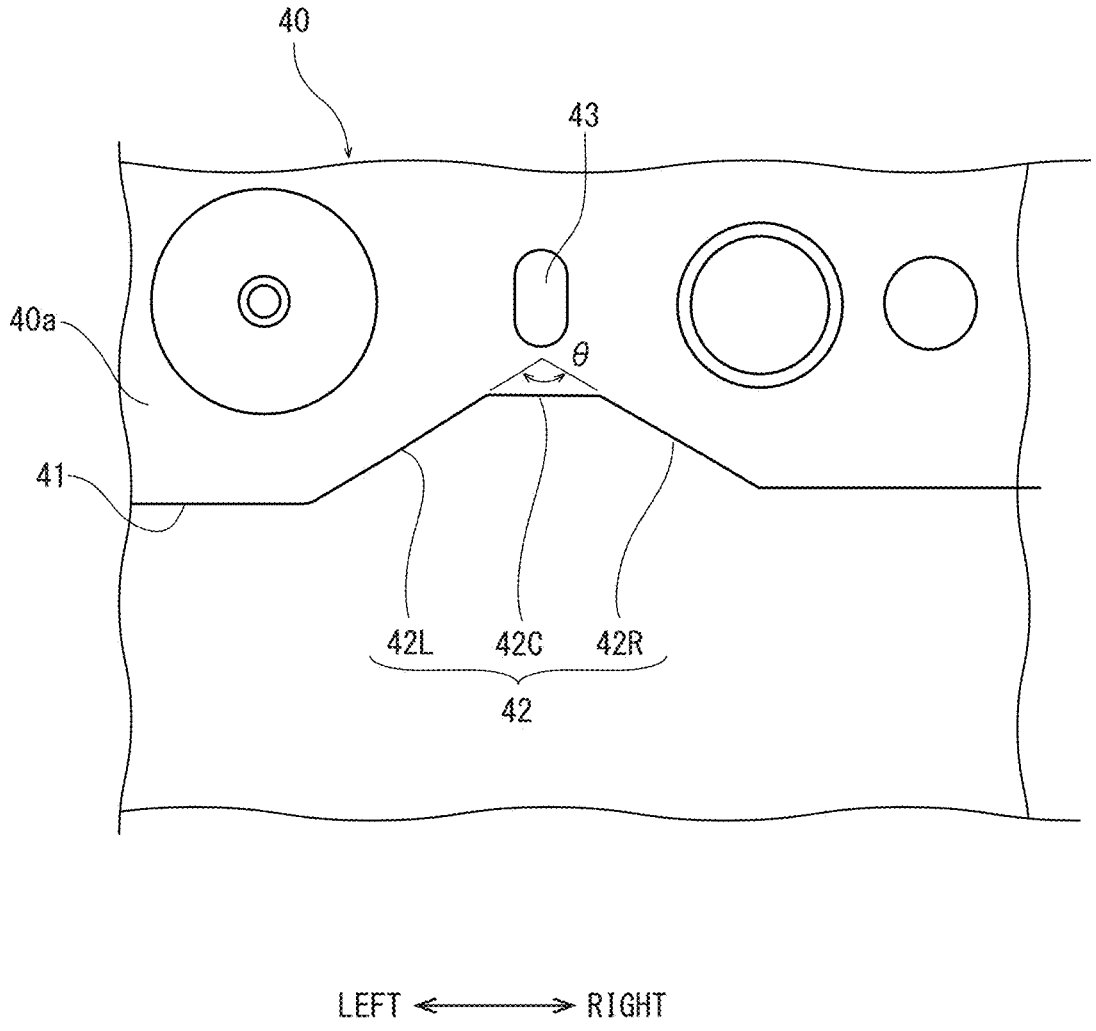

FIG.5

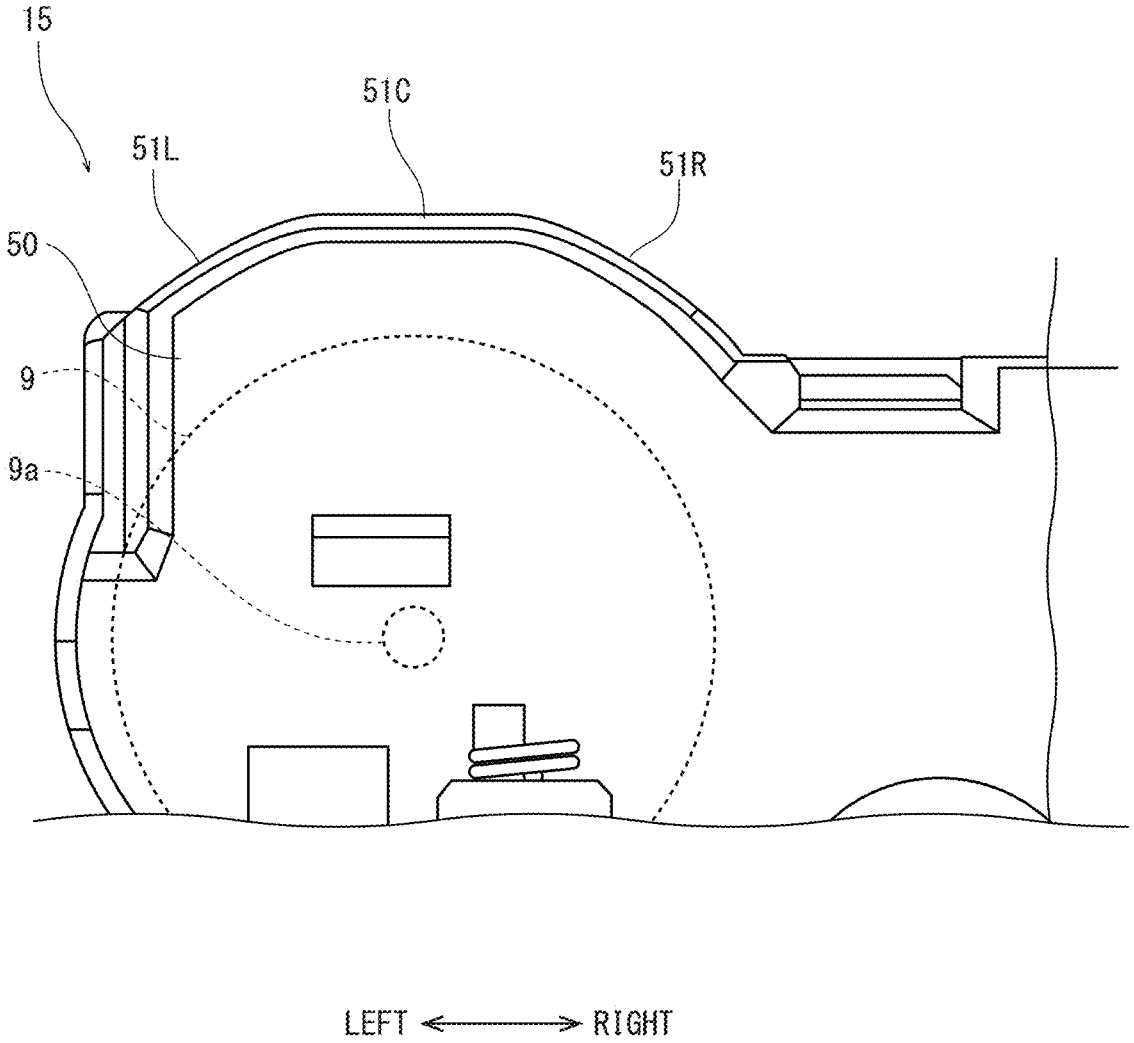

FIG.6A

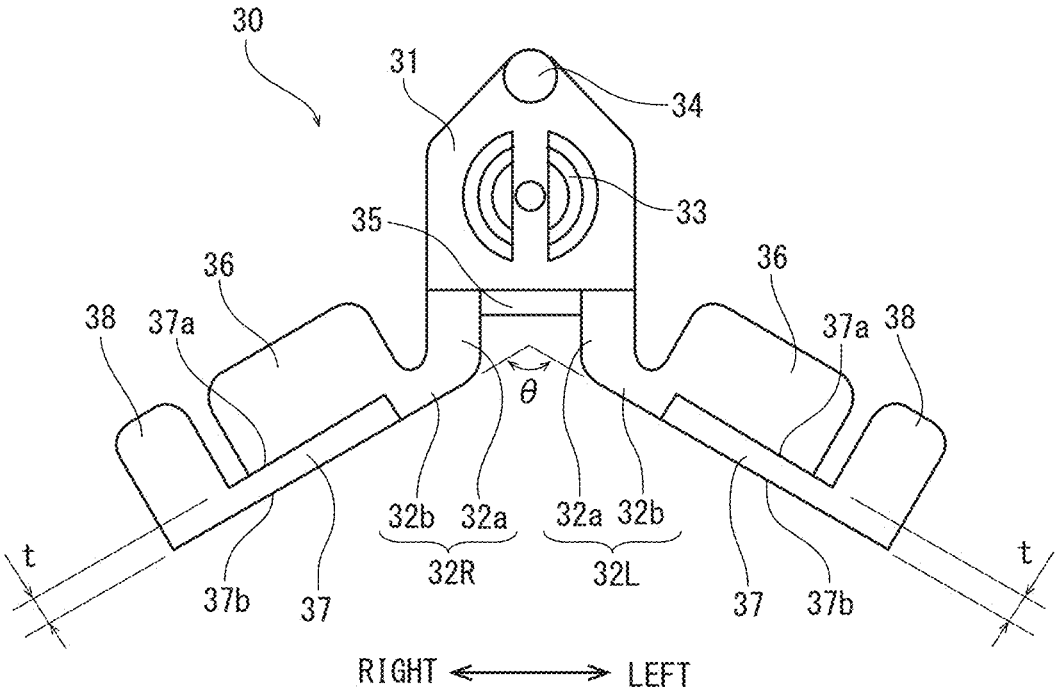
30
31
34
33
35
36
36
38
37a
37a
38
θ
32b
32a
32a
32b
32R
32L
t
37b
37
37
37b
t
RIGHT
LEFT

FIG.6B

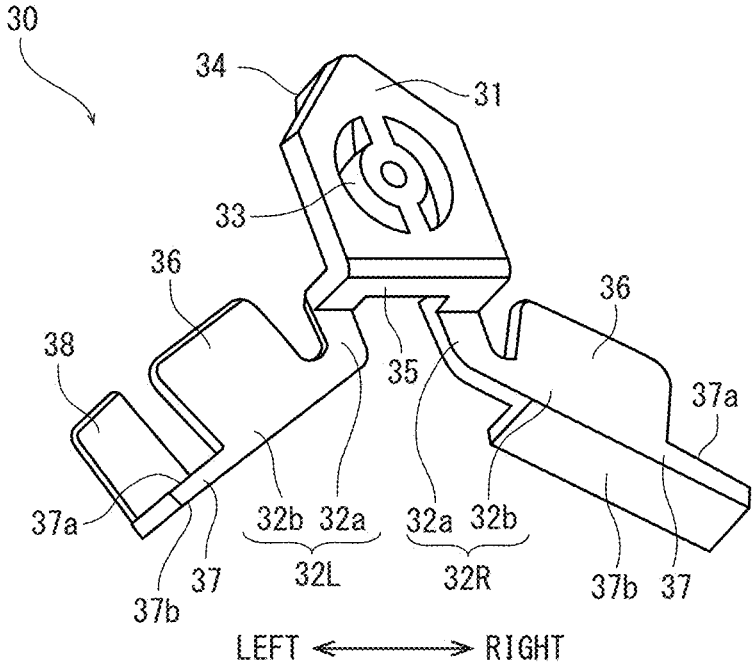
30
34
31
33
36
36
38
35
37a
37a
32b
32a
32a
32b
32L
32R
37b
37
37b
37
LEFT
RIGHT

FIG.7

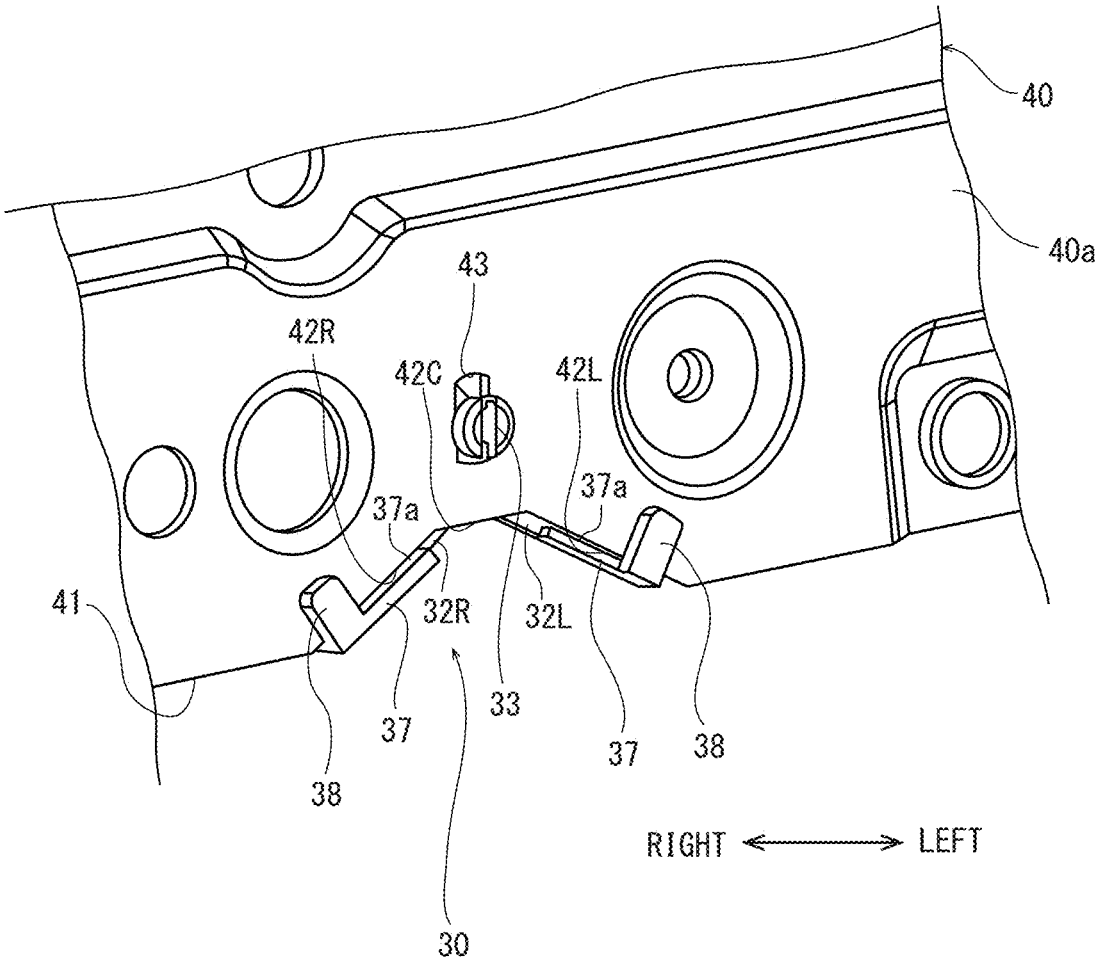
40
40a
43
42R
42C
42L
37a
37a
41
32R
32L
37
33
37
38
38
30
RIGHT
LEFT

FIG.8A

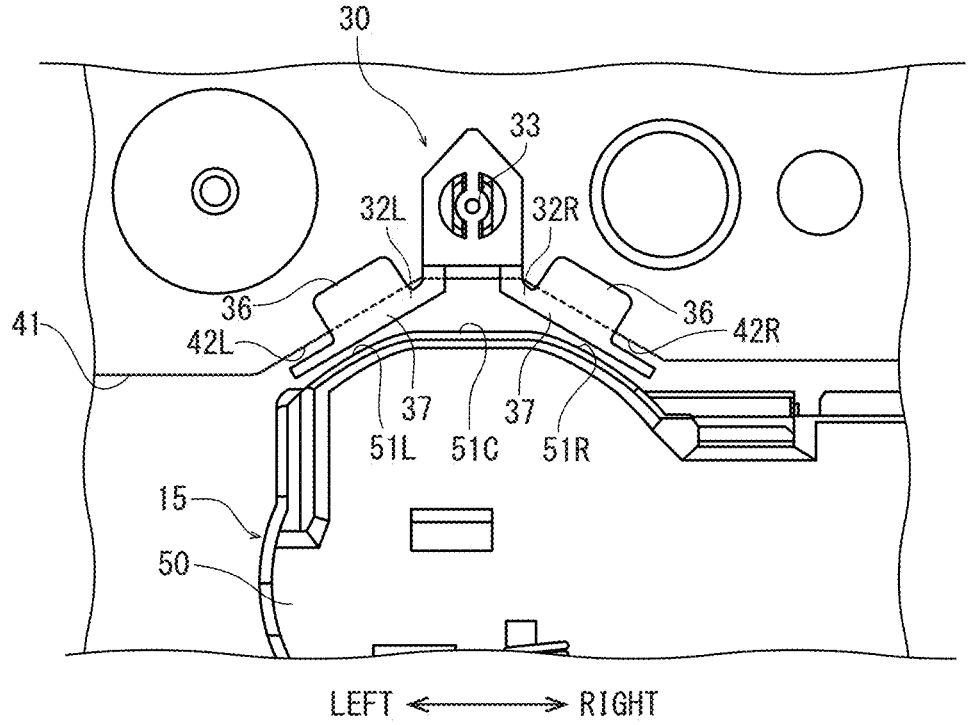
30
33
32L
32R
36
36
41
42L
42R
37
37
51L
51C
51R
15
50
LEFT
RIGHT

FIG.8B

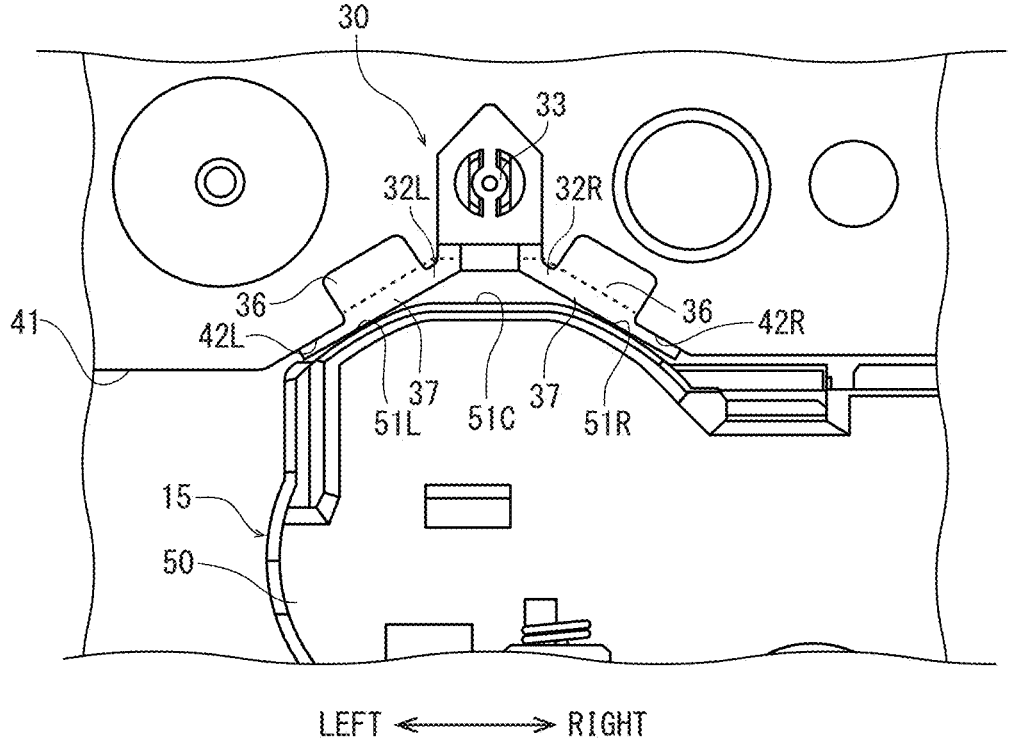
30
33
32L
32R
36
36
41
42L
42R
37
37
51L
51C
51R
15
50
LEFT
RIGHT

FIG.9

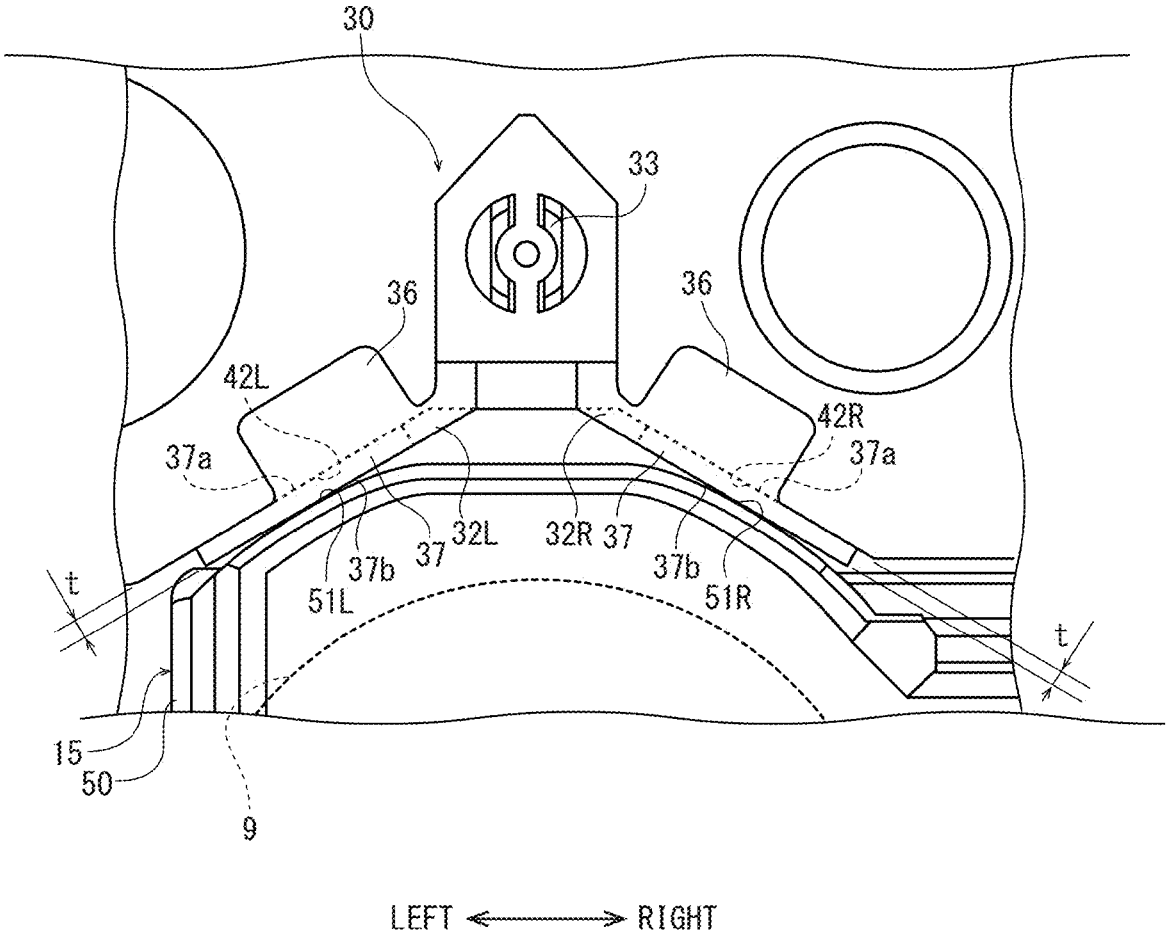
30
33
36
36
42L
42R
37a
37a
37
32L
32R
37
37b
37b
51L
51R
t
t
15
50
9
LEFT
RIGHT

FIG.10

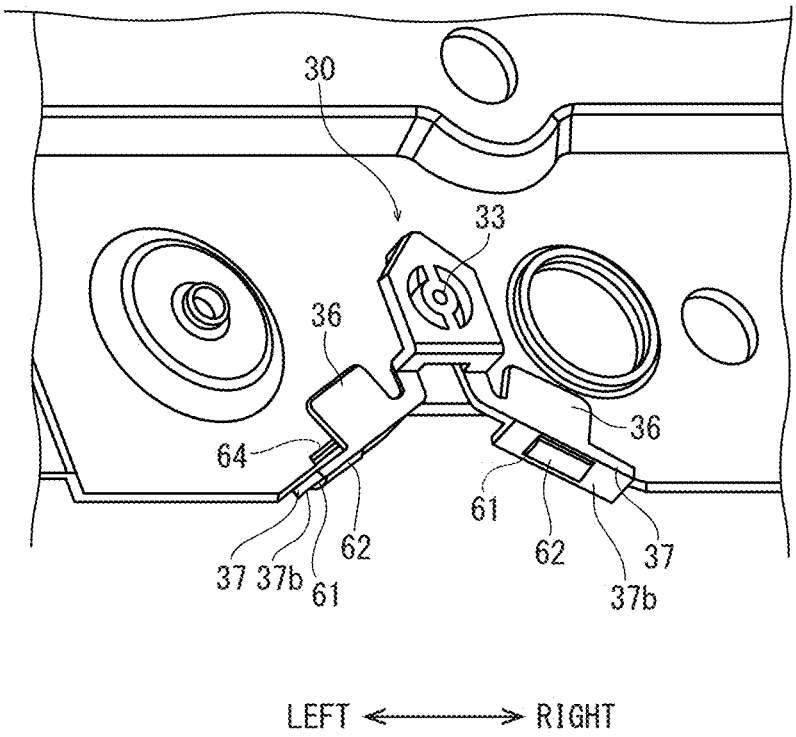

IMAGE FORMING APPARATUS

TECHNICAL FIELD

The present invention relates to an image forming apparatus provided with a drum unit which supports an image carrier such as a photosensitive drum.

BACKGROUND

An image forming apparatus, such as a copying machine, a printer or a multifunction peripheral, is sometimes constructed such that an image carrier on which an electrostatic latent image is formed, such as a photosensitive drum, a charging device, a cleaning device or the like are integrated into a unit and this unit is attachably/detachably supported to an apparatus main body by sliding operation. In an image forming apparatus for full color, since the units for every color are provided, in order to prevent color displacement, each of the units needs to be positioned with respect to the apparatus main body with a high precision.

In order to position each of the units with respect to the apparatus main body, there may be a case in which a retainer made of a metal plate is used. The retainer is a positioning member having a bearing hole into which a front end of a rotating shaft of the image carrier of each unit is to be inserted. In such each unit, a rear end of the rotating shaft of the image carrier is inserted into a shaft supporting hole formed in the apparatus main body and the front end of the rotating shaft is held in the bearing hole of the retainer. Then, by positioning the retainer with respect to the apparatus main body, it makes possible to improve a precision of a relative position of each image carrier.

As a construction to position each unit by employing the retainer, in Patent Literature 1, there is proposed an image forming apparatus configured such that a front end of a rotating shaft of an image carrier is held in a shaft supporting hole formed in the retainer by self-weight. This image forming apparatus is further provided with a pressing member to press and position the rotating shaft held in the shaft supporting hole and a sliding member to slide the pressing member between a pressing position where the pressing member presses the rotating shaft and a non-pressing position where the pressing member comes into non-contact with the rotating shaft.

PRIOR ART DOCUMENT

Patent Document

[Patent Document 1] Japanese Patent laid-open Publication No. 2007-41494

SUMMARY OF INVENTION

Problems to be Solved by the Invention

However, in the image forming apparatus shown in the Patent Literature 1, when each unit is attached to the apparatus main body, it is necessary to slide each unit to an attachment position with respect to the apparatus main body, subsequently attach the retainer so as to support the rotating shafts of the image carriers in the respective bearing holes, and further slide the sliding members to the pressing position to position the rotating shafts.

Also, while the apparatus main body and the retainer are formed of the metal plate as described previously, the units are generally made of resin; and therefore, the units may be damaged because the apparatus main body or the retainer comes into contact with the units at the time of sliding of the units or at the time of attaching the retainer.

In the construction in which the retainer is used, there are problems that the construction becomes complicated, resulting in higher costs, and the work of attaching and detaching the units is complicated or difficult, resulting in poor workability, and further, the units are easily damaged.

The present invention has been made in view of the circumstance described above, and it is an object of the present invention to provide an image forming apparatus capable of positioning an image carrier unit with respect to an apparatus main body with a simple construction.

Means of Solving the Problems

An image forming apparatus according to the present invention includes: an image carrier unit configured to rotatably support an image carrier on which an electrostatic latent image is to be formed and attachable to or detachable from an apparatus main body; and a positioning member configured to position the image carrier unit with respect to the apparatus main body at an attachment position, wherein the image carrier unit has a concentric circumference part formed on a concentric circle with a rotating shaft of the image carrier, the apparatus main body has an edge part facing the concentric circumference part at the attachment position, the positioning member has an intervening part formed with an edge side abutment face facing the edge part of the apparatus main body and a unit side abutment face facing the concentric circumference part of the image carrier unit, and wherein the intervening part is intervened between the concentric circumference part of the image carrier unit and the edge part of the apparatus main body so that the image carrier unit is positioned with respect to the apparatus main body.

Effects of the Invention

By employing such a construction, since the image carrier unit can be positioned with respect to the apparatus main body only by attaching the positioning member to the apparatus main body, the work of attaching and detaching the image carrier unit can be easily carried out. Further, in a full color image forming apparatus, since the image carrier units for each color of toner are positioned in an apparatus main body by employing the positioning members with a same construction, a relative position precision between the image carrier units is enhanced and thus a color displacement can be reliably prevented. Also, since the concentric circumference parts formed on the concentric circle with the rotating shaft of the image carrier is employed for positioning of the image carrier unit with respect to the apparatus main body, a positioning precision of the image carrier itself can be enhanced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view showing an outline of a construction of a color printer according to an embodiment of the present invention.

FIG. **2** is a perspective view showing a front end part of a drum unit viewed from a front side, in the color printer according to the embodiment of the present invention.

FIG. **3** is a perspective view showing the front end part of the drum unit viewed from a right side, in the color printer according to the embodiment of the present invention.

FIG. **4** is a front view showing a drum unit attachment opening of a printer main body, in the color printer according to the embodiment of the present invention.

FIG. **5** is a front view showing the drum unit, in the color printer according to the embodiment of the present invention.

FIG. **6**A is a rear view showing a positioning member, in the color printer according to the embodiment of the present invention.

FIG. **6**B is a perspective view showing the positioning member, in the color printer according to the embodiment of the present invention.

FIG. **7** is a perspective view showing the positioning member supported on the printer main body viewed from a rear side, in the color printer according to the embodiment of the present invention.

FIG. **8**A is a front view showing the drum unit before biased by a drum unit biasing mechanism, in the color printer according to the embodiment of the present invention.

FIG. **8**B is a front view showing the drum unit biased by the drum unit biasing member, in the color printer according to the embodiment of the present invention.

FIG. **9** is a front view showing the drum unit at an attachment position, in the color printer according to the embodiment of the present invention.

FIG. **10** is a perspective view showing another example of the positioning member, in the color printer according to the embodiment of the present invention.

THE MODE FOR CARRYING OUT THE INVENTION

Hereinafter, with reference to figures, an image forming apparatus according to an embodiment of the present disclosure will be described.

First, with reference to FIG. **1**, an entire structure of a color printer **1** (image forming apparatus) will be described. FIG. **1** is a schematic diagram schematically showing the color printer according to an embodiment of the present disclosure. In the following description, a front side of the sheet plane of FIG. **1** shows a front side of the color printer **1** and left and right directions are based on a direction viewed from the front side of the color printer **1**.

The color printer **1** is provided with a box-like shaped printer main body **2**. In a lower part of the printer main body **2**, a sheet feeding cassette **3** storing a sheet (not shown) and on an upper face of the printer main body **2**, an ejected sheet tray **4** is provided.

In a center part of the printer main body **2**, an intermediate transferring belt **6** is bridged between a plurality of rollers, and under the intermediate transferring belt **6**, an exposure device **7** containing a laser scanning unit (LSU) is arranged. Along the lower face of the intermediate transferring belt **6**, four image forming parts **8** for each color (for example, magenta, cyan, yellow and black) of toner are provided side by side in the left and right directions. In each image forming part **8**, a photosensitive drum **9** (image carrier) is rotatably provided. Around the photosensitive drum **9**, a charger **10**, a development unit **11**, a first transferring part **12**, a cleaning device **13** and a static eliminator **14** are arranged in the order of the first transferring process. The photosensitive drum **9**, the charger **10** and the cleaning device **13** are integrated into a drum unit (image carrier unit) **15**. Above the development units **11**, toner containers **7** for respective image forming parts **8** are provided for each color of the toner.

Along one side (the right side in the figure) of the printer main body **2**, a sheet conveying path **18** is formed extending from the sheet feeding cassette **3** to the sheet ejecting tray **4**. At the upstream end of the sheet conveying path **18**, a sheet feeding part **19** is provided, at the midstream portion of the sheet conveying path **18**, a second transferring part **20** is provided on one end (the right end in the figure) of the intermediate transferring belt **6**, at the downstream portion of the sheet conveying path **18**, a fixing device **21** is provided, and at the downstream end of the sheet conveying path **18**, a sheet ejecting port **22** is provided.

Next, the operation of forming an image by the color printer **1** having such a configuration will be described. When image data is inputted from a computer or the like connected to the color printer **1**, the image forming operation is carried out as follows.

After the surface of the photosensitive drum **9** is charged by the charger **10**, the exposure device **7** exposes the surface of the photosensitive drum **9** with a laser light (refer to an arrow P) to form an electrostatic latent image on the surface of the photosensitive drum **9**. The electrostatic latent image is then developed into a toner image of corresponding color by the developing unit **11**. The toner image is first-transferred on the intermediate transferring belt **6** at the first transferring part **12**. The above-mentioned operation is repeated in order by the image forming parts **9**, thereby forming a full color toner image onto the intermediate transferring belt **6**. Incidentally, toner and residual electric charge remained on the photosensitive drum **9** is removed by the cleaning device **13** and the static eliminator **14**, respectively.

On the other hand, the sheet fed from the sheet feeding cassette **3** by the sheet feeding part **19** or a bypass tray (not shown) is conveyed to the second transferring part **20** in a suitable timing for the above-mentioned image forming operation. Then, in the second transferring part **20**, the full color toner image on the intermediate transferring belt **6** is second-transferred onto the sheet. The sheet with the second-transferred toner image is conveyed to the downstream side along the sheet conveying path **18** to enter the fixing device **21**, and then, the toner image is fixed on the sheet in the fixing device **21**. The transfer sheet with the fixed toner image is ejected through the sheet ejecting port **22** to the ejected sheet tray **4**.

Next, the drum unit **15** will be described with reference to FIG. **2** to FIG. **5**. FIG. **2** is a perspective view showing the front end part of the drum unit attached to the printer main body, viewed from the front side; FIG. **3** is a perspective view showing the front end part of the drum unit attached to the printer main body, viewed from the right side; FIG. **4** is a front view showing the drum unit attachment opening of the printer main body; and FIG. **5** is a front view showing the drum unit.

The drum unit **15** is configured to be attachable to or detachable from the printer main body **2** by the sliding operation in an axial direction of a rotating shaft **9***a* of a photosensitive drum **9** and is positioned at an attachment position by a positioning member **30**.

A framework of the printer main body **2** is constructed by a casing **40** made of a metal plate. The casing **40** is formed in a box shape, and as shown in FIG. **2** and FIG. **3**, has a front side plate **40***a* and a rear side plate (not shown) which oppose to each other in the front and rear directions. The rear side plate is formed with a bearing hole to which the rotating shaft **9***a* of the photosensitive drum **9** is inserted, at positions

corresponding to respective photosensitive drums **9** of the drum units **15**. Also, the front side plate **40***a* is formed with an elongated substantially rectangular opening **41** into which the drum units **15** or the development units **11** are to be inserted. The opening **41** is divided into an attachment section to which corresponding drum unit **15** is to be attached.

In each of the attachment sections of the opening **41**, as shown in FIG. **4**, a flat trapezoidal notch **42** in a front view is formed along the upper edge. The notch **42** is formed symmetrically in the left and eight directions in a front view, and has a horizontal center edge **42**C, and a left edge **42**L and a right edge **42**R extending in a truncated reverse V-shape toward a left lower direction and a right lower direction from the left end and right end of the center edge **42**C, respectively. The left and right edges **42**L, **42**R extend in the reverse V-shape at a center angle θ. Above the center edge **42**C, a vertically long elongated hole **43** is formed.

In each of the attachment sections, as shown in FIG. **3**, a pair of left and right rails **44** are bridged between the front and rear side plates under the opening **41**. The rails **44** are inclined slightly upward toward the rear direction. Also, on an inside face of the front side plate **40***a*, a drum unit biasing mechanism **45** is provided under the opening **41**. The drum unit biasing mechanism **45** has a roller-shaped pressing member **45***a* and a coil spring to bias the pressing member **45***a* upward, and is configured to bias the drum unit **15** upward.

The drum unit **15**, as shown in FIG. **5**, has a box-shaped casing **50** made of resin. Inside of the casing **50**, the photosensitive drum **9** is housed rotatably around the rotating shaft **9***a*, and the charger **10** and the cleaning device **13** are housed at appropriate positions along the periphery of the photosensitive drum **9**. The rear end of the rotating shaft **9***a* of the photosensitive drum **9** protrudes rearward from the casing **50**.

The casing **50** is formed with left and right concentric circumferences parts **51**L, **51**R formed on a concentric circle with the rotating shaft **9***a* of the photosensitive drum **9** on the left and right sides of a horizontal flat plate part **51**C, respectively, on a part of the front end of the upper face. The left and right concentric circumferences parts **51**L, **51**R each have a same center angle (the center angle around the rotating shaft **9***a* of the photosensitive drum **9**) and are formed symmetrically in the left and right directions.

Further, on the lower face of the casing **50**, a sliding part (not shown) engaging with the rail **44** of the casing **40** is provided extending in the front and rear directions. Furthermore, as shown in FIG. **3**, on the front end of the lower face of the casing **50**, a protrusion **55** protruding downward is formed. A lower face of the protrusion **55** is formed to be flat.

The positioning member **30** will be described with reference to FIG. **6**A, FIG. **6**B or the like. FIG. **6**A is a rear view of the positioning member and FIG. **6**B is a perspective view of the positioning member. The positioning member **30**, as shown in FIG. **2**, is interposed between the notch **42** formed in the opening **41** of the front side plate **40***a* of the casing **40** and the left and right concentric circumferences parts **51**L, **51**R of the casing **50** of the drum unit **15**. As shown in FIG. **6**A and FIG. **6**B, the positioning member **30** has a supporting part **31** provided at the center and arm pieces **32**L, **32**R extending in a truncated reverse V-shape from the lower side of the supporting part **31** and is made of resin (for example, polypropylene resin).

The supporting part **31** is formed in a hexagonal flat plate shape in a front view. On the center portion of the rear face of the supporting part **31**, a supporting shaft **33** protruding rearward is formed. The supporting shaft **33** is formed of a pair of halves obtained by vertically dividing a three-stepped shaft with a gap extending in a vertical direction. Further, on the rear face of the supporting part **31**, an upper shaft **34** protruding rearward is formed above the supporting shaft **33**. A height of the upper shaft **34** is formed to be lower than a height of the supporting shaft **33**. Furthermore, along the lower edge of the supporting part **31**, a step part **35** bending rearward is formed.

The left arm piece **32**L and the right arm piece **32**R are provided in a truncated reverse V-shape in a front view so as to extend in the lower left direction and the lower right direction from the left end and the right end of the front edge of the step part **35**, respectively. The left arm piece **32**L and the right arm piece **32**R have proximal parts **32***a* extending downward from the left end and the right end of the front edge of the step part **35** and main body parts **32***b* extending linearly from tip ends of the proximal parts **32***a* in an oblique left lower direction and an oblique right lower direction, respectively. In the left and right arm pieces **32**L, **32**R, an angle θ between the main body parts **32***b* is formed to be equal to the angle θ between the left and right edges **42**L, **42**R (refer to FIG. **4**) in the notch **42** of the opening **41** of the casing **40**. The main body part **32***b* is formed with an elongated rectangular-shaped front tongue piece **36** extending upward along a portion close to the proximal part **32***a*. Further, on the rear face of the main body part **32***b*, an intervening part **37** is formed.

The intervening part **37** is flat-plate shaped elongated along the main body **32***b* and has a flat upper face (edge side abutment face) **37***a* and a flat lower face (unit side abutment face) **37***b*. The upper face **37***a* and the lower face **37***b* are formed in parallel to each other. As an example, an interval t (a thickness of the intervening part **37**) between the upper face **37***a* and the lower face **37***b* is 1 mm and a tolerance in a thickness direction of the intervening part **37** is ±0.02 mm or less. In addition, a length of the intervening part **37** in the front and rear directions is formed to be longer than a thickness of the front side plate **40***a* of the casing **40**. The intervening part **37** is provided along the lower edge of the main body part **32***b* on the rear face of the main body part **32***b* of each of the left and right arm pieces **32**L, **32**R. In the left and right arm pieces **32**L, **32**R, an angle between the upper faces **37***a* of the intervening parts **37** and an angle between the lower faces **37***b* of the intervening parts **37** are equal to the angle θ between the main body parts **32***b*.

On the rear face of the intervening part **37**, a rear tongue piece **38** extending upward is formed. The rear tongue piece **38** has a rectangular shape which is smaller in width than the front tongue piece **36**. The front tongue piece **36** and the rear tongue piece **38** are parallel to each other and are shifted in the left and right directions in a front view. Further, the front tongue piece **36** and the rear tongue piece **38** are perpendicular to the upper and lower faces **37***a*, **37***b* of the intervening part **37**.

A method of attaching the drum unit **15** to the printer main body **2** by employing the positioning member **30** having the above construction will be described with reference to FIG. **7** to FIG. **9** or the like. FIG. **7** is a perspective view showing the positioning member supported to the printer main body, viewed from the rear side; FIG. **8**A is a front view showing the drum unit before biased by the drum unit biasing mechanism; FIG. **8**B is a front view showing the drum unit after biased by the drum unit biasing mechanism; and FIG. **9** is a front view enlarging and showing the vicinity of the positioning member at the attachment position.

When the drum unit **15** is attached to the printer main body **2**, first, the positioning member **30** is caused to be supported to the casing **40** of the printer main body **2**. At this juncture, as shown in FIG. **7**, the supporting shaft **33** of the positioning member **30** is caused to be inserted from the front side into the elongated hole **43** formed above the opening **41** formed in the front sideplate **40***a* of the casing **40**. The supporting shaft **33** can be supported to the elongated hole **43** movably in the vertical direction and swingably in the left and right directions by deforming each of the halves inward. Incidentally, at this juncture, the supporting shaft **33** is inserted into a position close to the lower end of the elongated hole **43**.

In addition, when the left and right edges **42**L, **42**R of the notch **42** are respectively fitted between the front tongue pieces **36** and the rear tongue pieces **38** of the left and right arm pieces **32**L, **32**R, the upper faces **37***a* of the intervening parts **37** of the left and right arm pieces **32**L, **32**R respectively face the left and right edges **42**L, **42**R of the notch **42** at predetermined intervals. Also, the rear faces of the front tongue pieces **36** of the left and right arm pieces **32**L, **32**R face the front face of the front side plate **40***a* and the front faces of the rear tongue pieces **38** face the rear face of the front side plate **40***a*.

Incidentally, as described previously, the length of the intervening part **37** in the front and rear directions is formed to be longer than the thickness of the front side plate **40***a* of the casing **40**. Also, the supporting shaft **33** can be moved inside the elongated hole **43** in the front and rear directions by deforming inward. This makes it possible to move the positioning member **30** in the front and rear directions between a position at which the rear faces of the front tongue pieces **36** of the left and right arm pieces **32**L, **32**R abut against the front face of the front side plate **40***a* and another position at which the front faces of the rear tongue pieces **38** abut against the rear face of the front side plate **40***a*.

Namely, the positioning member **30** is supported in the front sideplate **40***a* so as to be movable in the vertical direction and swingable in the left and right directions and further movable in the front and rear directions.

Next, the drum unit **15** is caused to be positioned to corresponding attachment section of the opening **41** formed in the front side plate **40***a* of the casing **40**, a slider provided on the lower face of the casing **50** is caused to engage with the rail **44** (refer to FIG. **3**) bridged between the front and rear side plates of the casing **40** and then is caused to slide rearward along the rail **44**. When the drum unit **15** slides up to the rear end of the rail **44**, the rotating shaft **9***a* of the photosensitive drum **9** protruding from the rear face of the casing **50** is inserted into the bearing hole formed in the rear side plate. Incidentally, as described previously, since the rail **44** is inclined slightly upward toward the rear side, the drum unit **15** does not interfere with the transferring belt **6** during the sliding of the drum unit **15**.

When the drum unit **15** slides up to the rear end of the rail **44**, as shown in FIG. **8**A, the left and right concentric circumferences parts **51**L, **51**R provided on the front end portion of the upper face of the casing **50** are respectively positioned below the lower faces **37***b* of the intervening parts **37** of the left and right arm pieces **32**L, **32**R of the positioning member **30**. Further, as shown in FIG. **4**, the protrusion **55** provided on the lower face of the casing **50** abuts against the upper face of the pressing member **45***a* of the drum unit biasing mechanism **45** provided on the front side plate **40***a* and biases the front end of the drum unit **15** upward.

When the front end of the drum unit **15** is biased upward, as shown in FIG. **8**B, the left and right concentric circumferences parts **51**L, **51**R of the casing **50** move upward and abut against the lower faces **37***b* of the respective intervening parts **37** of the positioning member **30**. At this juncture, the supporting shaft **33** of the positioning member **30** swings in the left and right directions. This causes apexes of the left and right concentric circumferences parts **51**L, **51**R of the casing **50** to abut against the lower faces **37***b* of the intervening parts **37**. The intervening parts **37** are pushed upward by the left and right concentric circumferences parts **51**L, **51**R of the casing **50**. In the positioning member **30**, the supporting shaft **33** moves upward inside the elongated hole **43**.

Incidentally, while the positioning member **30** moves upward, since the front tongue piece **36** and the rear tongue piece **38** respectively provided at the left and right arm pieces **32**L, **32**R prevent the positioning member **30** from swinging in the front and rear directions, the intervening parts **37** are pushed up in a substantially parallel posture with the left and right edges **42**L, **42**R. The positioning member **30** moves upward until the upper faces **37***a* of the intervening parts **37** respectively abut against the left and right edges **42**L, **42**R of the notch **42** in the opening **41** of the front side plate **40***a*.

Afterwards, as shown in FIG. **9**, the upper faces **37***a* of the intervening parts **37** of the positioning member **30** abut against the left and right edges **42**L, **42**R of the front side plate **40***a* and also the apexes of the left and right concentric circumferences parts **51**L, **51**R of the casing **50** abut against the lower faces **37***b* of the intervening parts **37**. In this manner, an interval between the left and right edges **42**L, **42**R of the front side plate **40***a* and the respective left and right concentric circumferences parts **51**L, **51**R of the casing **50** is regulated to the thickness t of the intervening part **37**. In addition, the drum unit **15** is supported at a total of three positions including an abutment position between the pressing member **45***a* of the drum unit biasing mechanism **45** and the lower face of the protrusion **55** of the casing **50** and another two abutment positions between the apexes of the left and right concentric circumferences parts **51**L, **51**R of the drum unit **15** and the lower faces **37***b* of the intervening parts **37** of the positioning member **30**.

As has been described hereinabove, in the color printer **1** according to the embodiment, if the positioning member **30** is mounted to each elongated hole **43** formed above the opening **41** of the casing **40**, only the sliding operation of the drum unit **15** through the opening **41** at corresponding attachment section makes it possible to position the drum unit **15** with respect to the printer main body **2** by the positioning member **30**. Therefore, since the work of detaching or attaching the retainer as in the prior art is unrequired, the work of attaching or detaching the drum unit **15** can be made easy and a structure of the color printer **1** can be simplified. Also, since the opening **41** is formed in the front side plate **40***a* of the casing **40**, the sliding operation of each drum unit **15** or the positioning operation with respect to the printer main body **2** by employing the positioning member **30** can be easily carried out. Further, since each drum unit **15** is positioned by employing the positioning member **30** having a same structure, the precision of the relative position of each drum unit **15** can be enhanced and therefore degradation in image quality, such as color displacement, at the time of forming a color image does not occur.

In detail, since the drum unit **15** is supported at a total of three positions including an abutment position between the pressing member **45***a* of the drum unit biasing mechanism

45 and the lower face of the protrusion 55 of the casing 50 and another two abutment positions between the apexes of the left and right concentric circumferences parts 51L, 51R of the drum unit 15 and the lower faces 37*b* of the intervening parts 37 of the positioning member 30, the drum unit 15 can be precisely positioned with respect to the printer main body 2.

Further, at the abutment position between the pressing member 45*a* of the drum unit pressing mechanism 45 and the lower face of the protrusion 55 of the casing 50, a part on the circumferential face of the roller-shaped pressing member 45*a* abuts against the flat lower face. In addition, at the another two abutment positions between the left and right concentric circumferences parts 51L, 51R of the casing 50 and the lower faces 37*b* of the intervening parts 37, a part on the circumferential face of each of the left and right circumferences parts 51L, 51R abuts against the flat lower face 37*b* of the intervening part 37. Thus, since each contact area of the three abutment positions is formed to be extremely small, the positioning precision by supporting at these three positions is improved more remarkably.

Furthermore, since the drum unit 15 is positioned by the left and right concentric circumferences parts 51L, 51R of the drum unit 15 that is concentric with the rotating shaft 9*a* of the photosensitive drum 9, the positioning precision of the photosensitive drum 9 can be enhanced in particular.

Still furthermore, since the intervening parts 37 of the positioning member 30 each have a high tolerance in the thickness direction, intervals between the left and right concentric circumferences parts 51L, 51R of the drum unit 15 and the respective left and right edges 42L, 42R of the front side plate 40*a* of the casing 40 can be managed with a high precision. Therefore, the drum unit 15 can be positioned with respect to the printer main body 2 with a high precision.

Still furthermore, since the positioning member 30 made of resin is provided so as to cover the notch 42 of the opening 41 of the casing 40, the casing 50 of the drum unit 15 less frequently comes into direct contact with the edge of the opening 41 of the casing 40 during the sliding operation of the drum unit 15 and, therefore, it becomes possible to reduce risk of damage on the drum unit 15.

In addition, since the supporting shaft 33 of the positioning member 30 can be varied in the diameter within a certain degree by elastically deforming inward in the diametrical direction, the position of the supporting shaft 33 can be adjusted for every printer 1.

Next, with reference to FIG. 10, another embodiment of the positioning member will be described. In this embodiment, at the center of each intervening part 37 of the positioning member 30, an aperture 61 extending in the left and right directions is formed. Between the left and right side faces of each aperture 61, a rotating shaft extending in parallel with each arm piece 32 is provided. Around the rotating shaft, a roller 62 is rotatably supported. The rollers 62 protrude upward and downward from the upper face 37*a* and the lower face 37*b* of the intermediate part 37, respectively.

Also, along each of the left and right edges 42L, 42R of the casing 40, a depression 64 in which the upper portion of the roller 62 is housed is formed at a position to corresponding roller 62 of the positioning member 30 attached to the casing 40. By forming the depression 64, the rollers 62 do not come into contact with the left and right edges 42L, 42R.

In this construction, when the drum unit 15 is biased upward by the drum unit biasing mechanism 45, the left and right concentric circumferences parts 51, 51R each abut against an outer circumferential face of the roller 62. Therefore, when the drum unit 15 is caused to slide along the rail 44 at the time of attaching or detaching the drum unit 15, since the casing 50 comes into contact with the rollers 62, the sliding property between the casing 50 and the positioning member 30 can be enhanced. Hence, the sliding operation of the drum unit 15 can be smoothly carried out.

The embodiment was described in a case of applying the configuration of the present disclosure to the printer 1. On the other hand, in another embodiment, the configuration of the disclosure may be applied to another image forming apparatus, such as a copying machine, a facsimile or a multifunction peripheral, except for the printer 1.

While the preferable embodiment and its modified example of the image forming apparatus of the present disclosure have been described above and various technically preferable configurations have been illustrated, a technical range of the disclosure is not to be restricted by the description and illustration of the embodiment. Further, the components in the embodiment of the disclosure may be suitably replaced with other components, or variously combined with the other components. The claims are not restricted by the description of the embodiment of the disclosure as mentioned above.

The invention claimed is:

1. An image forming apparatus comprising:

an image carrier unit configured to rotatably support an image carrier on which an electrostatic latent image is to be formed and attachable to or detachable from an apparatus main body; and

a positioning member configured to position the image carrier unit with respect to the apparatus main body at an attachment position,

wherein the image carrier unit has a concentric circumference part formed on a concentric circle with a rotating shaft of the image carrier,

the apparatus main body has an edge part facing the concentric circumference part at the attachment position,

the positioning member has an intervening part formed with an edge side abutment face facing the edge part of the apparatus main body and a unit side abutment face facing the concentric circumference part of the image carrier unit, and

the image carrier unit is configured to be attachable to or detachable from the apparatus main body by sliding along an axial direction of the image carrier through an opening formed in the apparatus main body and to be attached to the apparatus main body by being biased upward at the attachment position,

the edge part of the apparatus main body is formed at left and right portions along the upper edge of the opening so as to form a truncated reverse V-shape in a front view,

wherein before the image carrier unit is biased upward at the attachment position, the intervening part of the positioning member faces the corresponding edge part of the apparatus main body at an interval,

when the image carrier unit is biased upward at the attachment position, the unit side abutment face of the intervening part is pressed by the corresponding concentric circumference part of the image carrier unit and then the edge side abutment face of the intervening part abuts against the corresponding edge part of the apparatus main body, then the intervening part is intervened between the concentric circumference part of the image carrier unit and the edge part of the apparatus main

body so that the image carrier unit is positioned with respect to the apparatus main body.

2. The image forming apparatus according to claim 1,

wherein the image carrier unit is biased upward at the attachment position by a roller-shaped pressing member, and

the image carrier unit is positioned with respect to the apparatus main body in the attachment position at three positions including an abutment position between the image carrier unit and the pressing member and at abutment positions between the concentric circumference parts and the respective intervening parts of the positioning member.

3. The image forming apparatus according to claim 1,

wherein the apparatus main body is made of a metal plate, and the image carrier unit and the positioning member are made of resin.

4. The image forming apparatus according to claim 1,

wherein the opening is formed in a front side plate of the apparatus main body.

5. The image forming apparatus according to claim 1 comprising a plurality of the image carrier units, wherein the positioning member is provided at the apparatus main body so as to correspond each of the image carrier units.

6. An image forming apparatus comprising:

an image carrier unit configured to rotatably support an image carrier on which an electrostatic latent image is to be formed and attachable to or detachable from an apparatus main body; and

a positioning member configured to position the image carrier unit with respect to the apparatus main body at an attachment position,

wherein the image carrier unit has a concentric circumference part formed on a concentric circle with a rotating shaft of the image carrier,

the apparatus main body has an edge part facing the concentric circumference part at the attachment position,

the positioning member has an intervening part formed with an edge side abutment face facing the edge part of the apparatus main body and a unit side abutment face facing the concentric circumference part of the image carrier unit,

wherein the positioning member has:

a supporting part which is supported to the apparatus main body movably in a vertical direction and swingably in a horizontal direction; and

a pair of arm pieces extending in a truncated reverse V-shape in a front view from a lower side of the supporting part, and

the intervening part is provided at each of the pair of arm pieces such that the edge side abutment face and the unit side abutment face extend in parallel to the corresponding arm piece,

wherein the intervening part is intervened between the concentric circumference part of the image carrier unit and the edge part of the apparatus main body so that the image carrier unit is positioned with respect to the apparatus main body.

7. The image forming apparatus according to claim 6,

wherein an angle between the pair of arm pieces of the positioning member is equal to an angle between the edge parts of the apparatus main body.

8. The image forming apparatus according to claim 6,

wherein the intervening part has:

a front tongue piece and a rear tongue piece respectively facing a front face and a rear face of the edge part of the apparatus main body; and

a roller formed on the unit side abutment face and rotatable along with the sliding of the image carrier unit.

9. An image forming apparatus comprising:

an image carrier unit configured to rotatably support an image carrier on which an electrostatic latent image is to be formed and attachable to or detachable from an apparatus main body; and

a positioning member configured to position the image carrier unit with respect to the apparatus main body at an attachment position,

wherein the image carrier unit has a concentric circumference part formed on a concentric circle with a rotating shaft of the image carrier,

the apparatus main body has an edge part facing the concentric circumference part at the attachment position,

the positioning member has an intervening part formed with an edge side abutment face facing the edge part of the apparatus main body and a unit side abutment face facing the concentric circumference part of the image carrier unit,

wherein the positioning member has:

a supporting part which is supported to the apparatus main body movably in a vertical direction and swingably in a horizontal direction; and

a pair of arm pieces extending in a truncated reverse V-shape in a front view from a lower side of the supporting part, and

the intervening part is provided at each of the pair of arm pieces such that the edge side abutment face and the unit side abutment face extend in parallel to the corresponding arm piece and has:

a front tongue piece and a rear tongue piece respectively facing a front face and a rear face of the edge part of the apparatus main body; and

a roller formed on the unit side abutment face and rotatable along with the sliding of the image carrier unit,

wherein the intervening part is intervened between the concentric circumference part of the image carrier unit and the edge part of the apparatus main body so that the image carrier unit is positioned with respect to the apparatus main body.

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